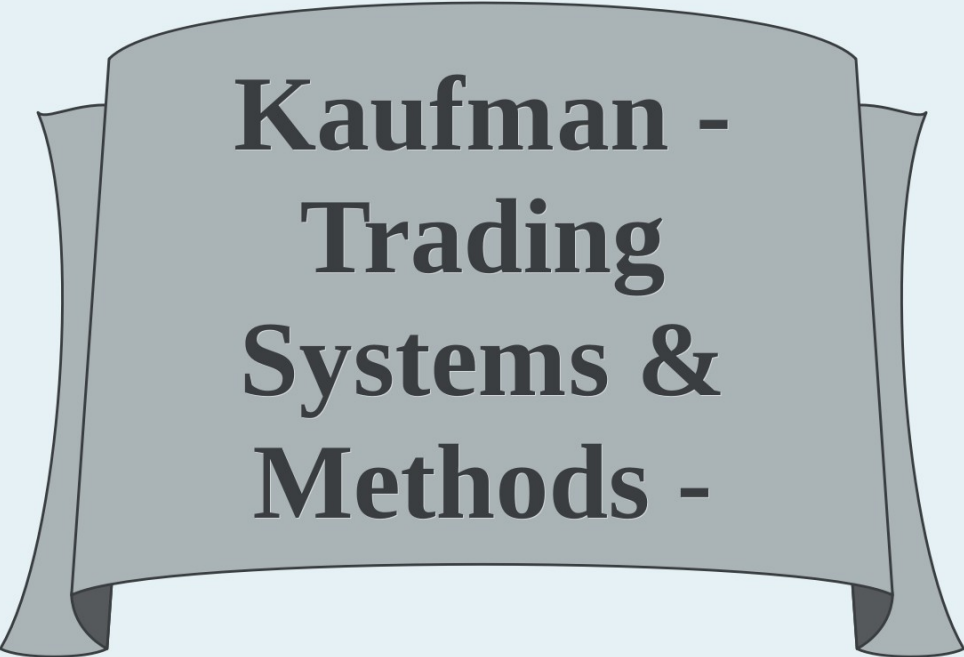




Kaufman - Trading Systems & Methods -

Chap07

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7 Seasonality

Chapter 3 introduced prices as a time series and identified its four components as the trend, the seasonal pattern, the cycle, and the chance movement~ it included various ways of finding the trend using statistical analysis and forecasting techniques. Chapter 4 then showed various ways to calculate trends. Of all techniques, the trend is overwhelmingly the most popular foundation for trading systems. In this and Chapter 8 „We will turn our attention to two other principal components, the seasonal and Cyclic movements.

Seasonality is a cycle that occurs yearly. it is most often associated with the planting and harvesting of crops, which can directly affect the feeding and marketing of livestock. Normally, prices are higher when a product is not as readily available, or when there is a greater demand relative to the supply as often occurs with food during the winter months. For grain, the season is dominated by planting, harvesting, and weatherrelated events that occur in between. Most crops have been produced in the Northern Hemisphere, but South American soybeans and orange juice have become significant factors since the early 1980s, as have Australian and New Zealand beef and lamb, resulting in a structural change in seasonal patterns. Globalization has not only affected financial markets, but nearly everything we purchase.

Consumer habits can cause a seasonal pattern in metals and stocks as Weather does for agricultural products. Passenger airline traffic is much heavier in the summer than in the winter, and profits of that industry, especially companies not diversified, reflect seasonality. Eastman Kodak once had a classic pattern caused by much more active picture taking during the summer months, when most workers take vacations. This seasonal activity also increased demand on silver, a major ingredient of film coating, which developed a codependent pattern before a substitute was found.

A CONSISTENT FACTOR

Even when the impact of seasonality on agricultural products is not clear from the price patterns, it is still there. Consider the following factors that do not change:

1. More corn, wheat, and soybeans are sold during harvest than at any other time of year because there is not enough available storage to hold all of the new crop. Rental storage, when available, requires a minimum threemonth charge. Lack of storage and the need for immediate income result in greater sales and cause prices to decline.
2. Because feedgrains are harvested only once each year, forward contracts include a storage cost as part of the total carrying charge. Therefore, each forward delivery price should be higher within the same crop year.

Sometimes the price pattern of forward months does not seem to reflect the added costs of carry. Occasionally these markets will even invert and the nearest delivery will trade at a price higher than the deferred months, a situation familiar to crude oil and copper. The cost of carry,

however, still exists in an inverted or backwardation market. Extreme shortterm demand pushes the nearest delivery much higher. while the events causing price disruption are expected to be temporary The normal carry is still there. it is just overw helmed by temporary demand.

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It is important to be able to identify seasonal patterns. The methods for finding them are simple, and made more so by the use of a spreadsheet and a computer. These will be discussed in this chapter along with some practical applications.

THE SEASONAL PATTERN

Seasonal patterns are easier to find than the longerterm cycles or economic trends, because they must repeat each calendar year. Although any 12month period can he used to find the seasonal pattern, academic studies usually begin with the new crop year for grains, just following harvest, when prices tend to be lowest. This approach will make the carrying charges, which increase steadily throughout the new crop year, more apparent. For uniformity, the examples in this chapter will always begin with a calendar year. which assumes no knowledge of where the season starts, and can be equally applied to stocks. it will always include carrying charges as an integral part of the market price.

United States agricultural production is considered to be the standard for seasonal. even though a wheat crop is harvested continuously throughout the year in different parts of the world. Prices are expected to he lower during the U.S. harvest and highest during the middle of the growing season. The influence of world stocks and anticipated harvest from other major producers in South America or Russia will cause an overall dampening or inflating of prices, rather than change the seasonal pattern. While the costs of transporting grain to the United States is not practical, except for special products. each purchaser in the world market will select a supplier at the best price. This fungibility has a direct impact on the U.S. market, which must alter its local price based on export demand.

Industrial commodities have seasonal price variation based on demand. Silver, although increasingly used in electronics as a conductor, is also consumed for jewelry, and photography, and has served as a general hedge against inflation. It still shows a seasonal pattern of greater demand during the summer months. Almost half of all copper is used in electrical and heat conductivity, with much of it in the form of an alloy with nickel and silver. its seasonality is heavily related to the housing industry, where it is required for both electrical and water systems. New sources of ore are introduced infrequently, and the possibility of discovery or expansion is rarely seen in price movement as shortterm anticipation. The primary supply problems in copper are related to labor as well as social and political changes in producing countries.

There are many businesses with finished products that have seasonal demand and their publicly traded stock prices will reflect that tendency~ Because the shares in a company are far removed from buying and selling the raw materials that they use, even major oil companies, such as Exxon, may not show a seasonal pattern similar to crude oil or its refined

products. As with Eastman Kodak, these firms have thoroughly diversified. and the impact of a \$ 1.00 increase in a barrel of oil or a \$50 increase in an ounce of silver will have only a small effect on the profitability of the firm, and may be the cause of stock prices advancing or declining. Yet some industries, such as airlines, still show seasonal patterns, and the same procedures given here can be used to find them.

POPULAR METHODS FOR CALCULATING SEASONALITY

Seasonal patterns are most often calculated using monthly data, although some studies have tried to pinpoint their periodic turns to specific days. As with most other analysis, closer observation or shorter time periods also bring more noise and erratic results. With this in mind, the seasonal studies in this chapter will use monthly data and keep an eye toward the big picture.

There is one important caveat about the prices used in some of these examples: they were created using a computer program that averaged the prices of a TradeStation contin

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uous contract. This contract is gapadjusted to remove the price jumps in futures when delivery months change; therefore, in the earlier years prices may be higher or lower than they actually were at the time. In the case of soybeans you will see that the prices in the mid1970s are about \$2 per bushel higher. In some cases, such as interest rates, prices that are 25 years in the past can actually become negative because of gap adjusting. A precise seasonal analysis will need to use continuous cash prices, rather than a constructed series, to have valid percentages. Results of these examples, however, show seasonality similar to p studies that use cash data. The following terminology and concepts will also be of help.

Basic Calculation Components

Average Prices

Finding the seasonal pattern does not need to be complicated; however, some basic rules must be followed to get sound results. For most analysts, it is easiest to begin with a spreadsheet, where the months are recorded in each column and the rows represent years (see Table 71). The average monthly price, placed in each cell, can give a good indication of seasonal patterns by simply averaging each column and plotting the results as shown in the first of four summary lines at the bottom. The major criticism of this technique is that it ignores the changing price levels over time. For example, a 25year study of soybeans will use prices that vary from \$6 to \$15 per bushel; price changes at the \$15 level could overwhelm other years.

Indexing the Data

A simple way to adjust for price differences over time is by indexing data, where each new entry is based on a percentage change from the previous value. This method will also work with seasonal studies, but must use unadjusted cash data. Because the monthly average prices for these examples were created from TradeStation continuous data, they cannot be used for this purpose.

Percentage Change

Over the many years needed for a seasonal study, prices may increase by a factor of two or three, and the magnitude of volatility at these different levels will vary significantly distorting the results. To correct for the problems associated with a longterm increase or decline in price, a monthly percentage change can be substituted for the average price. The use of percentages adjusts for most of the volatility changes and, at the same time, removes any longterm trend bias. It is a simple and very credible method for finding seasonality, but its results can be more erratic than the sophisticated calculations found in the next section.

Detrending

Removing the trend using a moving average, then comparing the percentage differences between the price and the corresponding trend value, is a classic approach to evaluating seasonality

Median Price

The median is the middle price of a series of values that have been sorted in numerical order. Instead of using an average monthly price, or the average of for example, all June average prices, using the median value should improve results. The median ignores the extreme prices that occur during some unusual years and gives a typical price. For example, if the average September price of heating oil was 50 cents per gallon for four years, but reached \$1.00 per gallon during one year, then the average would be 60 cents and the median would be 50 cents. Later in this chapter you might note that a large difference between the median and the average prices indicates that there were a few volatile years mixed with mostly normal patterns.

TABLE 7-1 A Simple Spreadsheet of Soybean Continuous Prices Used to Calculate Seasonality, January 1969–March 1994

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969		864.25	861.49	862.19	863.01	858.69	858.80	860.54	861.87	867.16	868.03	864.93
1970	867.63	869.54	869.60	872.78	874.63	884.77	897.16	886.76	886.35	899.88	903.66	893.26
1971	898.53	897.55	893.45	880.20	886.94	904.42	921.19	914.26	906.00	910.26	902.01	901.48
1972	895.65	902.05	919.41	929.94	926.67	921.09	923.55	933.46	938.41	939.28	964.17	1,014.17
1973	1,041.85	1,160.47	1,207.83	1,237.30	1,479.24	1,742.11	1,614.95	1,625.46	1,447.32	1,386.66	1,366.76	1,400.54
1974	1,421.55	1,440.51	1,421.02	1,349.11	1,333.74	1,338.68	1,494.40	1,564.05	1,550.65	1,641.64	1,557.45	1,502.73
1975	1,397.31	1,316.00	1,296.59	1,309.60	1,259.08	1,257.19	1,309.94	1,362.02	1,322.94	1,274.00	1,223.55	1,200.99
1976	1,202.23	1,206.63	1,198.87	1,199.08	1,242.14	1,346.01	1,390.06	1,343.23	1,374.02	1,334.56	1,354.56	1,378.63
1977	1,405.80	1,429.39	1,530.15	1,674.19	1,654.75	1,528.26	1,338.09	1,282.88	1,276.89	1,281.76	1,341.63	1,339.57
1978	1,318.89	1,308.17	1,405.67	1,432.15	1,457.25	1,430.45	1,402.49	1,401.79	1,429.71	1,462.75	1,450.14	1,454.29
1979	1,455.56	1,507.17	1,512.11	1,487.64	1,468.67	1,512.75	1,490.85	1,444.92	1,443.93	1,402.70	1,385.35	1,372.22
1980	1,349.35	1,345.31	1,296.90	1,258.64	1,265.33	1,273.88	1,381.11	1,389.58	1,443.61	1,462.46	1,503.93	1,376.24
1981	1,331.45	1,295.86	1,274.55	1,303.43	1,265.01	1,215.83	1,217.81	1,166.05	1,128.24	1,120.83	1,099.49	1,073.70
1982	1,071.16	1,061.58	1,043.26	1,069.54	1,066.54	1,031.98	1,014.69	970.88	942.15	925.95	952.31	946.44
1983	962.06	966.88	966.84	997.69	975.11	946.78	1,001.16	1,180.75	1,219.30	1,161.25	1,126.77	1,087.83
1984	1,050.26	1,013.08	1,063.32	1,061.60	1,115.75	1,044.36	925.35	905.08	881.33	884.79	882.83	851.28
1985	839.61	828.53	827.95	832.40	801.97	802.49	783.00	749.13	749.08	741.63	734.20	744.80
1986	751.60	732.11	734.80	727.88	736.89	731.60	729.80	712.85	721.77	723.93	738.30	730.17
1987	730.95	721.58	724.00	746.27	786.56	790.14	760.89	745.75	765.98	779.60	801.36	827.67

Effects of a Few Volatile Years

All seasonal calculations can be distorted by a few very volatile years that show large percentage price changes, especially during a time when there is not normally a strong seasonal bias. For example, if heating oil prices were stable for four years, or tended slightly lower, then jump 100% in one unusual period, the result of an OPEC announcement coupled

with low inventories, the average will show a seasonal increase of 20%. In fact, that is what happens in many markets in which one or two unrelated events cause a price change that can be interpreted as seasonal. In a computerized environment, the use of the median (discussed above) or more data can prevent mistakes; however, common sense will also show that a single odd year will erroneously distort the average.

Yearly Averages

The most basic way of measuring or describing seasonality is by the monthly variation. From the yearly average or crop average (for agricultural products), usually calculated as a ratio or percentage. The results of this technique using the 1975 corn prices can be seen in Table 72. During this one year, the highest prices occur in January and August and the lowest at the end of the year after harvest, confirming what we might expect of the corn season, with the exception of the January high. The average price for 1975 was 2.92, and the extent of variation throughout the year ranges, coincidentally, 13.7% above and below the average. By applying this method to the 20 years of data for corn shown in Table 73, the percentage variation can be shown in the corresponding Table 74. For those who prefer using negative percentages to show when values are below the average, simply subtract 100 from each number.

The longterm seasonality, called the seasonal adjustment factor, is the monthly average of the percentages shown in Table 74 and appears at the bottom of Table 74 and in Figure 71. These values must be divided by 100 before they can be correctly used as percentages. In both cases, the analysis has been separated into the two periods, 1956-1970 and 1971-1975, to indicate the changing volatility and slight change in pattern. The shaded area in Figure 71 represents the range in the percentage variation for the 1956-1970 period, and the broken lines show the corresponding 1971-1975 results. Figure 71 shows that the traditional seasonality can also have sharp fluctuations, reduced to intervals of short duration. The more recent period reflects the traditional seasonal highs and lows, but shows that there is a considerable wide range of other possibilities. All methods of determining seasonality will be influenced by those years in which unusual, overwhelming factors caused prices to move counter to normal seasonal patterns. A later section will discuss the advantages of distinguishing seasonal and nonseasonal years.

TABLE 7-2 Percentage of Monthly Corn Prices to the Average

	<i>Avg</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>
Price*	2.70	3.07	2.86	2.67	2.50
Percent	100.0	113.7	105.9	98.9	92.6
		<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>
Price		2.72	2.95	2.76	2.50
Percent		100.7	109.2	102.2	92.6

*Midmonth U.S. farm price, 1975.

TABLE 7-3 Corn Cash Prices

Year	Avg	Jan	Feb	Mar	Apr	May	Jun
1956*	1.30	1.14	1.16	1.19	1.32	1.41	1.44
1957	1.25	1.22	1.16	1.18	1.18	1.20	1.20
1958	1.10	.97	.98	1.04	1.18	1.20	1.23
1959	1.09	1.05	1.06	1.08	1.17	1.18	1.19
1960	1.03	1.03	1.04	1.04	1.09	1.11	1.11
1961	1.01	.99	1.03	1.04	.98	1.04	1.04
1962	.98	.94	.95	.96	.98	1.03	1.03
1963	1.11	1.03	1.05	1.06	1.09	1.12	1.19
1964	1.13	1.12	1.09	1.13	1.15	1.18	1.17
1965	1.18	1.16	1.17	1.19	1.22	1.25	1.26
1966†	1.25	1.19	1.20	1.17	1.19	1.21	1.20
1967	1.17	1.28	1.26	1.28	1.26	1.25	1.26
1968	1.04	1.04	1.06	1.06	1.06	1.09	1.07
1969	1.12	1.08	1.09	1.09	1.12	1.19	1.18
1970	1.24	1.12	1.14	1.13	1.15	1.18	1.21
1971	1.27	1.42	1.43	1.43	1.41	1.38	1.43
1972	1.17	1.09	1.09	1.10	1.13	1.15	1.13
1973	1.86	1.39	1.35	1.37	1.42	1.16	1.99
1974	2.92	2.59	2.76	2.68	2.41	2.45	2.57
1975	2.70	3.07	2.86	2.67	2.68	2.66	2.68
Average		1.30	1.30	1.29	1.31	1.32	1.38
1976		2.44	2.48	2.50			

*1956–1965 midmonth Illinois farm prices (U of I).

†1966–1975 midmonth U.S. farm prices (CRB Yearbook).

A general formula for the monthly average is:¹

$$APP_i = 100 \left\{ \frac{1}{N} \left[12 \sum_{n=1}^N \left(P_{in} / \sum_{j=1}^{12} P_{jn} \right) \right] \right\}, \quad i = 1, 2, \dots, N$$

where APP_i is the average percentage price in month i

i is the calendar month from 1 to 12

N is the number of years in the analysis

P_{jn} is the average price for month j of year n

This formula may be applied to weekly or quarterly average prices by changing the 12 to 52 or 4, respectively.

The use of an annual average price can bias a clear seasonal pattern because of its inability to account for a longterm trend in the price of the commodity. If the rate of inflation in the United States is 6%, there will be a tendency for each month to be 1/2% higher, resulting in a trend toward higher prices at the end of the year. Longer trends, such as the steady rise in grain prices from 1972–1975, followed by a longer decline in the 1980s, will obscure or even distort the seasonality unless the trend is removed.

¹David Handmaker, "Low-Frequency Filters for Seasonal Analysis," in Handbook of Futures, Perry J. Kaufman (ed.) (John Wiley & Sons, New York, 1984).

TABLE 7-4 Corn Price as Percentage Average (Annual)

Year	Avg	Jan	Feb	Mar	Apr	May	Jun	Jul
1956	1.30	87.6	89.2	91.5	101.5	108.5	110.8	111.5
1957	1.25	97.6	92.8	94.4	94.4	96.0	96.0	96.8
1958	1.10	88.2	89.1	94.5	107.3	109.1	111.8	111.8
1959	1.09	96.3	97.2	99.1	107.3	108.2	109.2	107.3
1960	1.03	100.0	101.0	101.0	105.8	107.8	107.8	107.8
1961	1.01	98.0	102.0	103.0	97.0	103.0	103.0	104.9
1962	.98	95.9	96.9	97.9	100.0	105.1	105.1	104.1
1963	1.11	92.8	94.6	95.5	98.2	101.0	107.2	109.0
1964	1.13	99.1	96.5	100.0	101.8	104.4	103.5	100.9
1965	1.18	98.3	99.1	100.8	103.4	105.9	106.8	105.1
1966	1.25	95.2	96.0	93.6	95.2	96.8	96.0	101.6
1967	1.17	109.4	107.7	109.4	107.7	106.8	107.7	103.4
1968	1.04	100.0	101.9	101.9	101.9	104.8	102.9	100.0
1969	1.12	96.4	97.3	97.3	100.0	106.2	105.3	96.4
1970	1.24	90.3	91.9	91.1	92.7	95.2	97.6	100.0
1956-1970	Avg	96.3	96.9	98.1	100.9	103.9	104.7	104.0
1971	1.27	111.8	112.6	112.6	111.0	108.7	112.6	107.1
1972	1.17	93.2	93.2	94.0	96.6	98.3	96.6	97.4
1973	1.86	74.7	72.6	73.6	76.3	62.4	107.0	109.1
1974	2.92	88.7	94.5	91.8	82.5	83.9	88.0	99.6
1975	2.70	113.7	105.9	98.9	99.2	98.5	99.2	100.7
1971-1975	Avg	96.4	95.8	94.2	93.1	90.1	100.7	102.8

Removing the Trend

Jake Bernstein, most well known for his seasonal studies,² uses the method of first differences to remove the trend from prices before calculating the seasonal adjustment factor. He offers the following steps for determining the cash price seasonality:

1. Arrange the data used in a table with each row as one year. Columns can be daily, weekly, or monthly, although most analyses will use monthly. Average prices are preferred for each period (see Table 71).
2. Compute a second table of monthtomonth differences by subtracting month 1 from month 2, month 2 from month 3, and so on. This new table contains detrended values.

3. Calculate the sum of the price differences in each column (month) in the new table. Find the average for that column by dividing the number of years of data (columns may have different numbers of entries). This is the average price change for that month.

4. From the table, count the times during each month (column) that prices were up, down, or unchanged. This will give the frequency (expressed as a percent) of movement in each direction.

Bernstein adds the average monthly changes together, expresses the frequency of upward price changes, and presents the results of corn in Figure 72.

Jacob Bernstein, *Seasonal Concepts in Futures Trading* (John Wiley & Sons, New York, 1986).

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FIGURE 71 Changes in volatility and variations in seasonal patterns for corn.

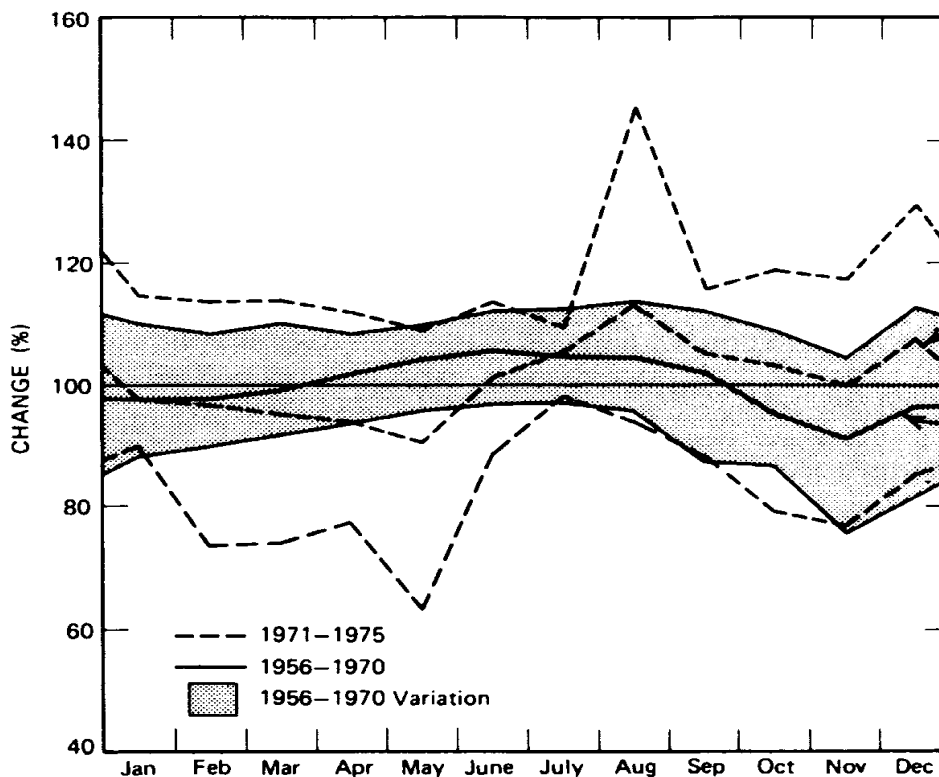
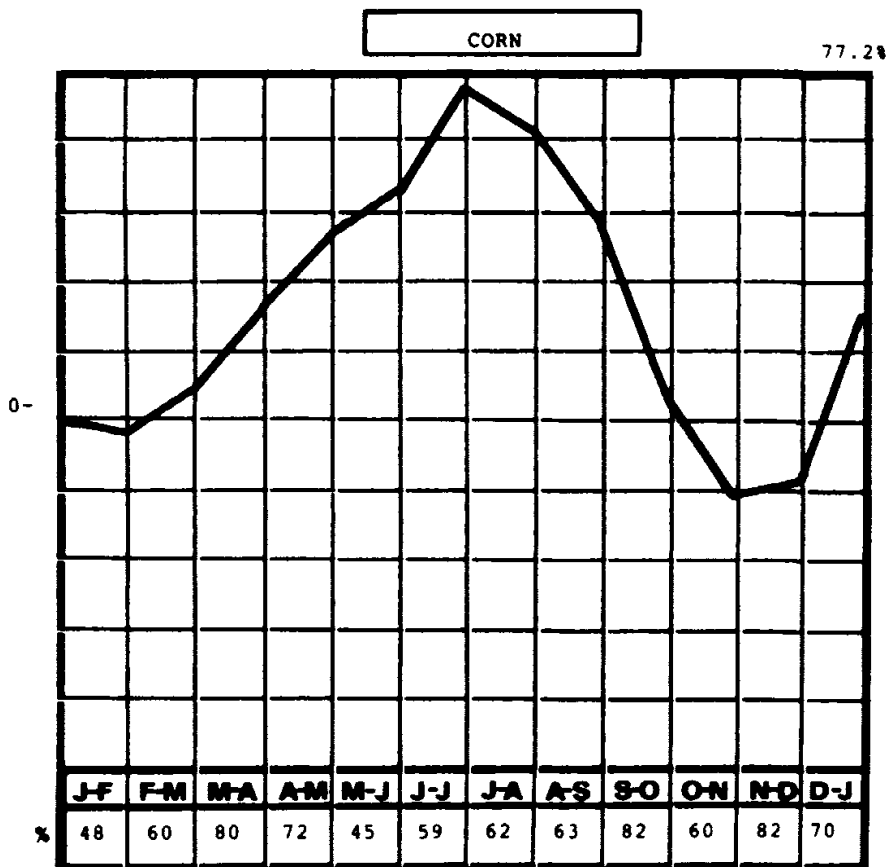


FIGURE 72 Seasonal price tendency in monthly cash average corn prices (1936-1983).



Source.. jacob Bernstein, Seasonal Concepts in Futures Trading (NewYork: John Wiley& Sons, 1986, p. 3 1). Reprinted with permission of John Wiley & Sons, Inc.

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The Method of Link Relatives

Another interesting and important way of identifying the seasonal price variations and separating them from other price components involves the use of link relatives. In Table 75 each month during 1960 and 1961 is expressed as a percentage by taking the ratio of that average monthly price to the average price of the preceding month (found in Table 73) in a manner similar to an index.

After the initial calculation of 1960 and 1961 link relatives, it is necessary to find the average (or the median, which is preferred if an adequate sample is used) of the monthly ratios expressed in rows (1) and (2). The average in row (3) represents monthly variation as a percentage of change. each calculation is a function of the preceding month. Thus far, this is the same as Bernstein's average monthly price changes, expressed as a percent of the prior price.

To establish a fixed base in the manner of an index, chain relatives

are constructed using January as 100; each monthly chain relative is calculated by multiplying its average link relative by the average link relative of the preceding month. The March chain relative is then $1.005 \times 1.025 = 1.030$, and February remains the same because it uses January as a base.

A constant trend throughout the test period can be found by multiplying the December chain relative (4) by the January average link relative. If prices show no tendency for either upward or downward movement, the result would be 1.00; however, inflation should cause an upward bias and, therefore, the results are expected to be higher. From line (4), the December entry multiplied by the January entry on line (3) gives $.946 \times 1.047 = .990$, leaving a negative factor of .1% unaccounted. This means that the 1960-1961 years showed a .1% downward bias; therefore, the expected rate of inflation was offset by some other economic factor, such as the accumulation of grain stocks by the U.S. government.

The chain relatives must be corrected by adding the negative bias back into the values, using the same technique as in computing compound interest. For example, from 1967-1977, the Consumer Price Index increased from 100 to 175, a total of 75% in 10 years. To calculate the annual compounded growth rate for that period, apply the formula:

$$\text{Compound rate of growth} = \sqrt[N]{\frac{\text{ending value}}{\text{starting value}}} - 1$$

where N is the number of years or the number of periods over which the growth is compounded.

$$R = \sqrt[10]{\frac{175}{100}} - 1$$

$$= 1.05755 - 1$$

$$= .05755$$

TABLE 7-5 Corn Prices Expressed as Link Relatives

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
(1) 1960	1.040	1.010	1.000	1.048	1.018	1.000	1.000	.982	.982	.907	.84
(2) 1961	1.053	1.040	1.010	.942	1.061	1.000	1.019	.981	.981	.980	.91
(3) Average	1.047	1.025	1.005	.995	1.040	1.000	1.010	.982	.982	.944	.87
(4) Chain relatives	1.000	1.025	1.030	1.000	1.035	1.040	1.010	.992	.964	.927	.82
(5) Corrected chain relatives	1.000	1.024	1.028	.997	1.032	1.036	1.005	.986	.958	.920	.82
(6) Indices of seasonal variations	1.022	1.046	1.050	1.019	1.054	1.058	1.027	1.007	.979	.940	.84

This indicates a compounded rate of inflation equal to 5.75% per year. In the case of corn, if the trend had been positive, that is, greater than

1.00 instead of .990, the growth rate would be subtracted from each month to offset the upward bias. In this case, the results are added back into the chain relative to compensate for the negative influence. A .1% decline, compounded over 12 consecutive entries gives:

$$\begin{aligned} R &= \sqrt[12]{\frac{.99}{1.00}} - 1 \\ &= .99916 - 1 \\ &= -.00084 \end{aligned}$$

This is a compounded deflation of about 8/100 of 1%. The corn found by multiplying the February entry by $(1 + R) = .99916$, March and December by $(1 + R)^{11} = .99076$.

The chain relatives have been calculated on a base of January, correct the compounded bias throughout the test period. The final corrected chain relatives to a base of the average value. The average used to create line (6), taking the ratio of the corrected chain relative to the average. The final result is the *Index of Seasonal Variation*. The accuracy is proved by averaging the entries of line (6), which will be 1.00. The seasonality using this method can be found in Courtney Smith, *Seasonal Traders* (Wiley, 1987).

The Moving Average Method

The moving average is a much simpler, yet very good technique for determining seasonal patterns. Looking again at the cash corn prices in Table 73, take the average quarterly prices for the years 1960-1965 rounded to the nearest cent. More practical results may be obtained by repeating this procedure for monthly prices.

Because every four entries completes a season, a 4-quarter moving average is calculated and recorded in such a way that each value lags 2 1/2 quarters, corresponding to the center of the 4 points used in the calculation. Column 2 of Table 76 shows the 4-quarter moving average positioned properly; Figure 73 is a plot of both the quarterly corn prices and the lagged moving average. By using the exact number of entries in the season, the moving average line is not affected by any seasonal pattern.

Because there was an even number of points in the moving average, each calculation falls between two original data points. Column 3 of Table 76 is constructed by averaging every two adjacent entries in column 2 and placing the results in a position corresponding to the original data points. This avoids smoothing the initial prices. The difference of column 1 minus column 3 is the seasonal adjustment factor (column 4) in cents per bushel; the seasonal index (column 5) is the ratio of column 1

divided by column 3. The periodic fluctuation of prices becomes obvious once these values have been recorded. A generalized seasonal adjustment factor and seasonal index are calculated by taking the average of the quarterly entries for the five complete years (Table 77).
X.-11

The seasonal adjustment method X11 (Census Method 11X11) is most widely used for creating a seasonally adjusted series of such information as car and housing sales, as well as other consumer products. It is very extensive, involving both an initial estimation

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TABLE 76 Seasonal Adjustment by the Moving Average Method

		Average Quarterly Price	4-Point Moving Average	Corresponding 4-Point Values	Seasonal Adjustment Factor
1960	Jan-Mar	104	103 $\frac{1}{4}$	103	-6 $\frac{1}{4}$
	Apr-Jun	110			
	Jul-Sep	109			
	Oct-Dec	90			
1961	Jan-Mar	102	100 $\frac{3}{4}$	100 $\frac{3}{8}$	-1 $\frac{1}{8}$
	Apr-Jun	102			
	Jul-Sep	104			
	Oct-Dec	95			
1962	Jan-Mar	95	98 $\frac{3}{4}$	98 $\frac{3}{8}$	-3 $\frac{3}{8}$
	Apr-Jun	101			
	Jul-Sep	101			
	Oct-Dec	95			
1963	Jan-Mar	105	103 $\frac{1}{2}$	106 $\frac{1}{8}$	-1 $\frac{1}{8}$
	Apr-Jun	113			
	Jul-Sep	122			
	Oct-Dec	109			
1964	Jan-Mar	111	114 $\frac{1}{4}$	113 $\frac{3}{8}$	-2 $\frac{1}{8}$
	Apr-Jun	117			
	Jul-Sep	115			
	Oct-Dec	108			
1965	Jan-Mar	117	116	116 $\frac{3}{4}$	-6 $\frac{1}{4}$
	Apr-Jun	124			
	Jul-Sep	121			
	Oct-Dec	109			

TABLE 7-7 Average Seasonal Variation Using the Moving Average Method

Average of All Years	Seasonal Adjustment Factor	Seasonal Index
Jan-Mar	-1.15	.988
Apr-Jun	+3.53	1.052
Jul-Sep	+4.43	1.042
Oct-Dec	-7.00	.932

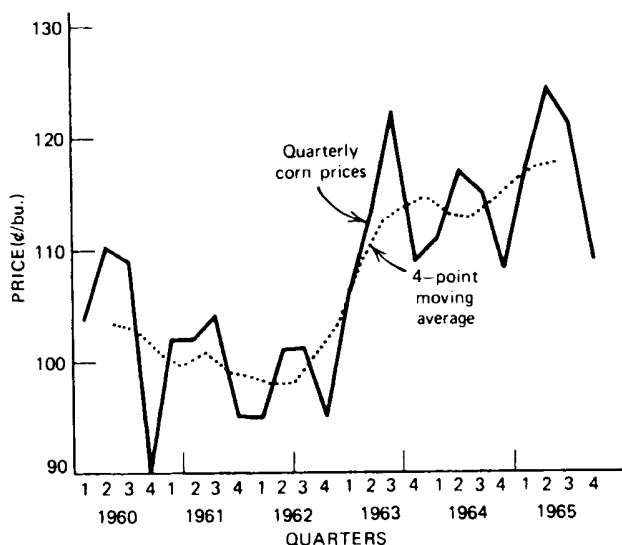
and reestimation. Because it is widely used by economists, an outline of its procedure follows.'

1. Calculate a centered 12month moving average (MA). Subtract this MA from the original series to get an initial detrended seasonal series.

'A more detailed account of X11 and Henderson's weighted ~ ing average (step 9) can be found in Bo~ as Abraham and johannes Ledolter. Statistical ,Methods for Forecasting (John \X ilc\ & Sons. New York. pp. 178191) Their book also includes a computer program for seasonal exponential smoothing

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FIGURE 73 Detrending corn using a moving average with a yearly period.



2. Apply a weighted 5period MA to each month separately to get an estimate of the seasonal factors.
3. Compute a centered 12month MA of the seasonal factors (step 2)

for the entire series. Fill in the six missing values at either end by repeating the first and last available MA values. Adjust the seasonal factors from step 2 by subtracting the centered 12 term MA. The adjusted seasonal factors will total approximately zero over any 12 month period.

4. Subtract the seasonal factor estimates (step 3) from the initial detrended seasonal series (step 1). This is the irregular component series used for outlier adjustment.

5. Adjust the outliers in step 4 by the following procedure:

a. Compute a 5-year moving standard deviation s of the series (step 4).

b. Assign weights to the series components c_i as follows:

0 if $c_i > 2.5s$

linearly scaled from 0 to 1 if $2.5s \geq c_i \geq 1.5s$

1 if $c_i < 1.5s$

Use this weighting function to adjust the detrended series in step 1.

6. Apply a weighted 7period MA to the adjusted series (step 5) to get the preliminary seasonal factor

7. Repeat step 3 to standardize the seasonal factors.

8. Subtract the series resulting in step 7 from the original series to find the preliminary seasonally adjusted series.

9. To get the trend estimate, apply a 9, 13, or 23period Henderson's weighted moving average' to the seasonally adjusted series (step 8). Subtract this series from the original data to find a second estimate of the detrended series.

'A specialized symmetric assignment of weighting values. A specific example can be found in Bovas Abraham and Johannes Ledolter, Statistical Methods for Forecasting (John Wiley & Sons, New York, p. 178).

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10. Apply a weighted 7period MA to each month separately to get a second estimate of the seasonal component.

11. Repeat step 3 to standardize the seasonal factors.

12. Subtract the final seasonal factors from the original series to get the final seasonally adjusted series.

Winter's Method

Another technique for forecasting prices with a seasonal component is Winter's method, a selfgenerating, heuristic approach.' it assumes that the only relevant characteristics of price movement are the trend and seasonal components, which are represented by the formula

$$X_t = (a + bt)S_t + e_t$$

where X_t is the estimated value at time t

$(a + bt)$ is a straight line that represents the trend

S_t is the seasonal weighting factor

e_t is the error in the estimate at each point

If each season is represented by N data points, S_t repeats every N

$$\sum_{t=1}^N S_t = t$$

The unique feature of Winter's model is that each new observation is used to correct the previous components a , b , and S . Without that feature, it would have no applicability to commodity price forecasting. Starting with 2 or 3 years of price data, the yearly (seasonal) price average can be used to calculate both values a and b of the linear trend. Each subsequent year can be used to correct the equation $a + bt$ using any regression analysis. Winter's method actually uses a technique similar to exponential smoothing to estimate the next a and b components individually. The seasonal adjustment factors are assigned by calculating the average variance from the linear component, expressed as a ratio, at each point desired. As more observations are made, each component can be refined, and it will take on the form of the general longterm seasonal pattern.

A Comparison of Seasonality Using Different Methods

Heating oil and soybeans represent two fundamentally sound seasonal markets. Even before we analyze the patterns, we can expect heating oil to post higher prices during the winter months and soybeans to be high during the summer. Heating oil is accumulated beginning in midsummer in anticipation of the winter season, while soybeans are subject to speculative volatility during planting and growing seasons.

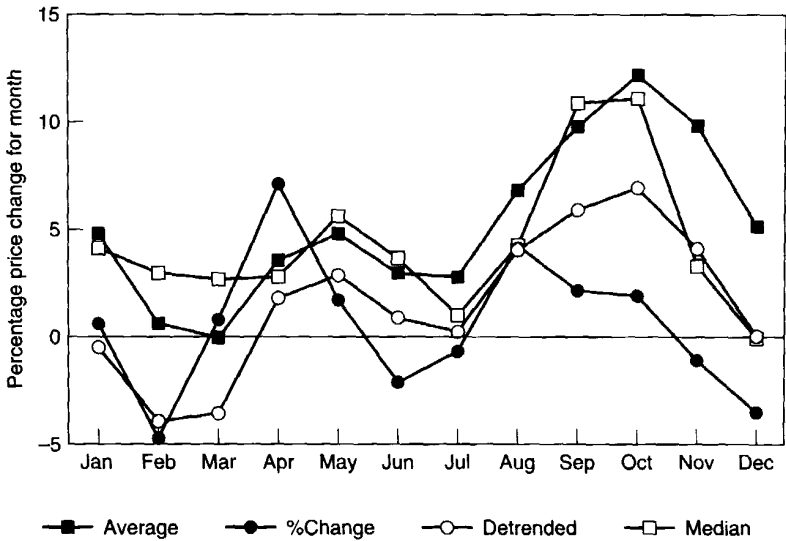
For the purposes of comparison, we will use four basic methods of calculating seasonality: average price, median price, percentage change from the previous month, and the moving average deseasonalizing. For our purposes, more complicated methods are unnecessary.

Figure 74a shows that the peak price for heating oil is most likely to come in October, well below the coldest months of the year. According to these techniques, it is the anticipation of winter that drives prices up, while February and March, typically colder, show lower average prices as most consumers use up the oil they had committed to buy during the previous September and October. Three of the methods for calculation gave similar results, while %Change seems to lead by one month.

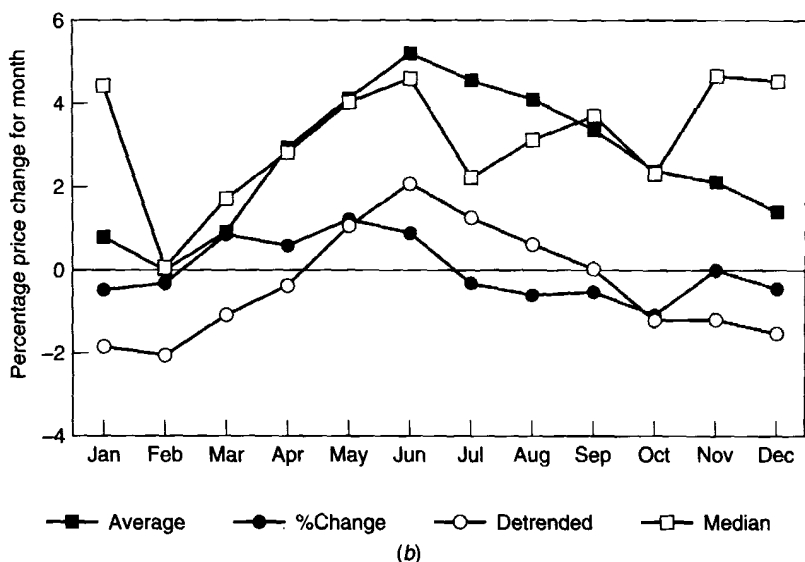
¹ Winter's method, as well as other advanced models, can be found in Douglas C. Montgomery and Lynwood A. Johnson's *Forecasting and Time Series* (McGraw-Hill, New York, 1976), and Bovas Abraham and Johannes Ledolter's *Statistical Methods for Forecasting* (John Wiley & Sons, New York 1983).

with %Change leading the other methods by one month. Peak prices come in October, during the time of greatest accumulation, with lower prices in February and March when consumers are normally depleting inventory. (b) Soybean seasonal patterns. The four basic calculations show soybean prices peaking in June and reaching lows in February. The use of the median gives results in July that are much lower than the average, and higher during the period November through January, indicating that there were unusually extreme moves during those months that distort the average.

Heating oil seasonality 1980Mar 1994
All years from continuous data



(a)
Soybean seasonality 1969-1993
All years from continuous data



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When applied to soybeans, all four basic seasonal calculations produce patterns that show the expected winter and summer cycles, with most lines rising and falling smoothly throughout the year (see Figure 74b). Again, it should be noted that the seasonal pattern of the percentage price changes leads the normal and detrended methods because it acts in the same way as momentum; a decline in the percentage change does not mean that current prices are lower than the previous month, but that prices did not increase by as much as the previous month.

Seasonal Volatility

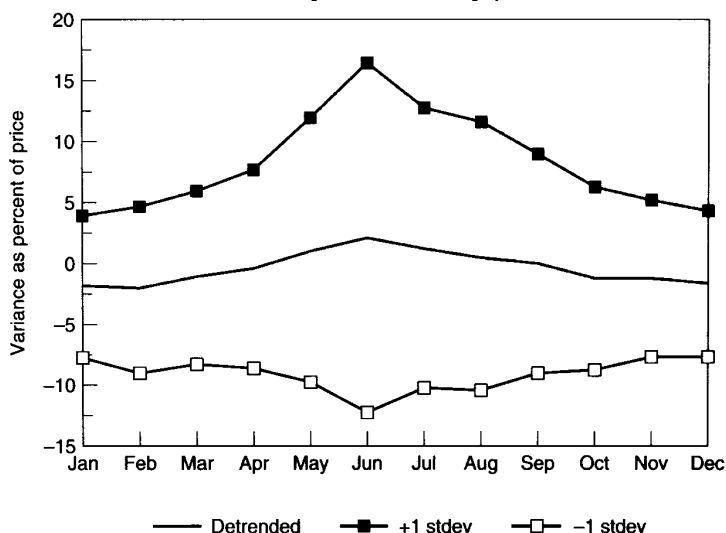
Consistent seasonal patterns can be confirmed by a corresponding increase in volatility as the season reaches its peak as seen in Figure 75. In this soybean chart, the peak volatility in June, represented by one standard deviation of price equal to about 12%, shows that there is a 68% chance that soybeans will vary by 24% in June. For the purpose of confirming the validity of the seasonal results, the steady increase and decrease in volatility surrounding the peak month of June indicates a building of the seasonal concerns that cause wide fluctuations. If a single price shock had occurred, unrelated to seasonality, there would be a sharp increase in volatility during one month, perhaps declining afterward, but with no steady growth of volatility leading up to this event.

WEATHER SENSITIVITY

The effects of changes in weather, especially extremes in weather, are an inseparable part of seasonal effects. Without weather, the price of an agricultural commodity would lack the surprises that cause them to jump around during the growing period. Once planted, you would have a very good idea of the expected supply; onehalf of the supplydemand equation would be constant each year.

Each agricultural product has its own particular sensitivity to weather. Grain planting can be delayed due to rain, causing some farmers to switch from corn to soybeans; hot weather during pollination will significantly reduce yields; a freeze in September can stop the ripening

FIGURE 75 Soybean monthly price variation.



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process and damage production. Freezes are of greater concern than droughts and affect more products. In general, patterns for crop sensitivity to weather depend upon their location in the Northern or Southern Hemisphere. Active trade between world markets shows that crops grown primarily in the Northern Hemisphere are affected by weather developments in the Southern Hemisphere. In Table 78 major weather events are shown separated into Southern and Northern Hemisphere. Figure 76 combines the soybean and corn weather sensitivity charts to show the effects of both Southern and Northern Hemisphere weather.

Measuring Weather Sensitivity

While a weather sensitivity chart, such as shown in Figure 76, may appear to have a strong similarity to a standard seasonal chart, they are actually very different. Weather sensitivity is a measurement of potential price volatility. It could simply be the highest price that the market reached during a period in which the weather event occurred. Those more adept at statistics would want to record the increase in price from the average during those months in which weather was a factor, then show the price representing the 95% confidence level.

A thorough approach to measuring weather sensitivity is to record the temperature each day and find out whether it is unusually far above or below the average. Information available from the U.S. weather or meteorological service will give you both regional weather and measurements of effective heat. It is the cumulative effect of heat that is damaging to a crop, rather than a high temperature for one day. In addition,

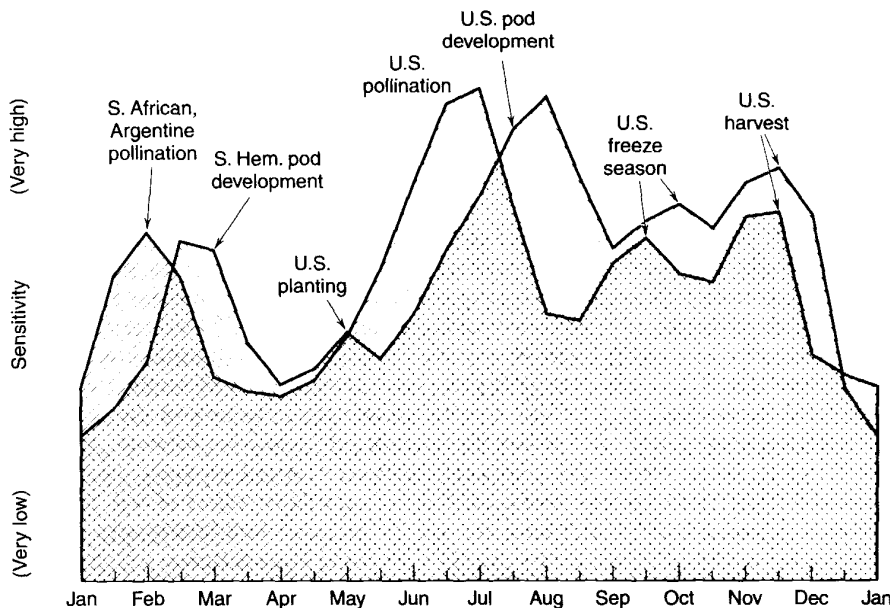
the amount of crop damage is not simply a linear relationship with rising temperatures; rather, it is more likely to start slowly and increase quickly once critical levels of time and heat are reached.

6 jon Davis, Weather Sensitivity in the Markets (Smith Barney, October 1994).

TABLE 78 WeatherRelated Events in the Southern and Northern Hemispheres

	Southern Hemisphere	Northern Hemisphere
January		OJ peak for Florida freeze
	Heating oil cold or hot	
February	Corn pollination in S. Africa and Argentina	Heating oil cold or hot
	Soybean pod development	
March		
April	Cotton planting	
May	Soybean planting	
June		Cotton boll development
July	Coffee freeze Brazil	Sugar: heat in Russia
	OJ freeze Brazil	Corn pollination
	Cocoa pod development in W Africa and pod rot in Brazil	
August		Soybean pod development
September		Atlantic hurricanes affect sugar. orange juice, heating oil
		Corn freeze
October		Soybean freeze
	Cotton harvest	
November		Coffee in Brazil rainy season
	Soybean harvest	
	Com harvest	
December		Heating oil cold or hot

FIGURE 76 Weather sensitivity for soybeans and corn.



Source: Smith Barney.

SEASONAL FILTERS

Seasonal filters identify periods during the year in which you would favor either a long or short position in a market based upon a clear seasonal component. These periods are normally chosen from the results of a calculation that uses detrended data; however, where there is a large difference between the median value and the average value, we should expect the median value to be more representative of expected price movement. The large difference between the median and average also tells us to expect extreme prices and high volatility during those months. This can be seen in Table 79, showing monthly soybean prices as a percentage of the annual average price. The doubledigit values in 1973, 1977, and 1988 are enough to cause the averages at the beginning of the year to be lower than the median, and June, July, and August to be higher than the median. This bias is mainly the result of only 3 of 24 years.

Using the examples of heating oil and soybeans, which have been discussed in the previous section, we can select the months with the largest and most reliable seasonal price moves as the best choice for seasonal filters. We can also separate the year into upward and downward cycles to allow for a wider range of trades. The following periods could be considered for heating oil and soybeans:

	<i>Best Choice (Partial Year)</i>	<i>Full Year</i>
Heating oil	Long from August 1 to November 1 Short from November 1 to March 1	Long from August 1 to November 1 Short from November 1 to March 1
Soybeans	Long from March 1 to July 1 Short from July 1 to November 1	Long from March 1 to July 1 Short from July 1 to November 1

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TABLE 7-9 Monthly Soybean Prices as a Percentage Difference from the Average Annual Price, February 1969–December 1993

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
69		0.17	-0.15	-0.07	0.02	-0.48	-0.47	-0.26
70	-1.83	-1.62	-1.61	-1.25	-1.04	0.11	1.51	0.33
71	-0.31	-0.42	-0.88	-2.35	-1.60	0.34	2.20	1.43
72	-4.10	-3.42	-1.56	-0.43	-0.78	-1.38	-1.12	-0.06
73	-25.18	-16.67	-13.26	-11.15	6.23	25.10	15.97	16.73
74	-3.16	-1.87	-3.20	-8.10	-9.14	-8.81	1.80	6.55
75	7.98	1.69	0.19	1.20	-2.71	-2.85	1.22	5.25
76	-7.34	-7.00	-7.60	-7.58	-4.26	3.74	7.14	3.53
77	-1.25	0.41	7.48	17.60	16.24	7.35	-6.01	-9.89
78	-6.65	-7.41	-0.51	1.37	3.15	1.25	-0.73	-0.78
79	-0.10	3.44	3.78	2.10	0.80	3.83	2.32	-0.83
80	-0.94	-1.24	-4.79	-7.60	-7.11	-6.48	1.39	2.01
81	10.25	7.30	5.54	7.93	4.75	0.67	0.84	-3.45
82	6.26	5.31	3.49	6.10	5.80	2.37	0.66	-3.69
83	-8.32	-7.86	-7.86	-4.92	-7.08	-9.78	-4.59	12.52
84	7.91	4.09	9.25	9.08	14.64	7.31	-4.92	-7.00
85	6.79	5.38	5.31	5.87	2.00	2.07	-0.41	-4.72
86	2.82	0.16	0.52	-0.42	0.81	0.09	-0.16	-2.48
87	-4.46	-5.68	-5.37	-2.46	2.81	3.28	-0.55	-2.52
88	-12.45	-12.92	-12.34	-8.34	-2.36	18.32	12.91	9.32
89	11.07	6.75	8.28	3.23	2.50	1.71	0.36	-5.51
90	1.10	0.21	2.39	3.24	4.90	1.11	0.89	0.39
91	4.33	4.42	4.56	4.73	1.49	-0.15	-4.66	-0.49
92	1.32	2.32	4.03	1.15	4.78	6.02	-1.51	-4.59
93	-6.34	-7.79	-6.09	-4.82	-3.49	-3.33	12.00	6.95
Avg	-0.94	-1.29	-0.42	0.16	1.25	2.06	1.44	0.75
Mdn	-0.63	0.16	-0.15	-0.07	0.81	1.11	0.66	-0.26

one practical note is needed here. Although there may appear to be a statistical benefit to selling heating oil in the later part of winter, there is also extreme risk. Prices jumped 40% from March to April 1982, and 20% during the same period in 1983. We must also consider that the Gulf War, which pushed prices higher from August 1990, conformed by chance to the seasonal pattern; in reality, it could have happened any time during the year. These special situations do not always cause prices to rise. In 1986, Saudi Arabia decided to dump oil in a politically motivated effort to drive

prices down, successfully pushing crude oil under \$ 10 per barrel.

Years with Similar Characteristics

Seasonal studies often yield results that are not as clear as desirable, and these results may be rejected because of the obvious lack of consistency. Often, this is caused by a few years that conflict with the normal seasonal patterns due to special events. David Handmaker shows that separating the data into analogous years can give strikingly better results.⁷

⁷ David Handmaker, "Low Frequency Filters in Seasonal Analysis," *Journal of Futures Markets*, Vol. 1, No. 3 (John Wiley & Sons, New York, 1981).

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For example, crop production is primarily determined by weather. Poor weather will cause sharp rallies during the growing season, whereas good weather results in a dull, sideways market. Bad weather develops slowly. A drought is not caused by the first hot day but prolonged days of sunshine and no rain. Similarly, delayed planting due to wet fields or a late winter will set the stage for an underdeveloped crop. A trader can see the characteristics of a weather market in time to act on it.

In Figure 77a, the seasonal corn pattern has been separated into those years with good weather and those with bad weather. In a later study by ContiCommodity,⁸ soybean seasonality was separated into bull and bear years (Figure 77b). Bull years include all bad weather years but also years with such incidents as the 1973 Soviet grain sale. Because other events are not confined to the growing months, they may distort rather than clarify the patterns. Bear would represent mostly good weather patterns; however, markets that decline steadily during the year following a bull market would also be included.

During the bad weather years, the corn chart shows a prolonged rise during the primary growing months, May through August. The study of bull years for soybeans shows a longer sustained rise from the beginning of the new crop in October into the following June. In the case of good weather and bear markets, corn shows a rise from May to June, some sideways hesitation from June to July (possibly the last anticipation of bad weather), then a return to previous price levels. For bear years soybeans have steady declines through April and then a short rally through the summer.

The corn analysis shows a critical point around July 1, when the market decides that the weather is not a factor. The soybean analysis is completely different showing nearly the opposite patterns for bull and bear markets. Because the resulting pattern of combining both bull and bear markets looks very similar to the bull pattern, the magnitude of the bull moves must overwhelm the overall picture. In fact, the magnitude of the bull moves are often three to four times greater than the price change in bear markets.

Updating Bull, Bear, and Nonseasonal Market Patterns

Both the Handmaker and ContiCommodity studies ended in the early 1980s and while grain fundamentals have essentially remained the

same, the use of more data and recent years can only help understand seasonality better. Using the soybean average prices expressed as a percentage of average annual price in Table 79, we separated the years from 1969 to 1993 into bull and bear categories, where bull years (and bear years) had significantly higher (or lower) prices at the end of the year than at the beginning. Table 710, parts (a) and (b), which also give the prices as a percent of the average annual price, show that there were about the same number of years in each category. The averages at the bottom of those tables indicate that both bull and bear years had a price swing of about 10% over the year.

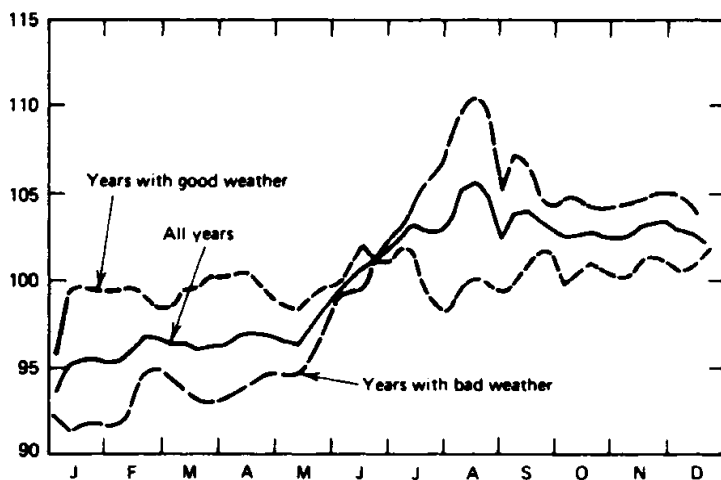
Bull and bear years are nearly opposite in pattern, as seen in Figure 78, and cross at about the same price in June. This makes the seasonal pattern using all years peak in June. As interesting as it is to know that there are an equal number of years going the opposite directions within a seasonal pattern, the bull and bear tables were created after the fact and can not be traded unless you know in advance that a bull or bear year will occur. Instead, it is possible to look at nonseasonal years, those in which the price of soybeans was higher during the harvest months of September and October than during the previous summer months.

One important quality of crops is that each year we begin again; a shortage one year does not mean a shortage the next year. This is seen in the chart of nonseasonal years in Figure 78. After a nonseasonal year, prices rally early, nervous about planting and shortages,

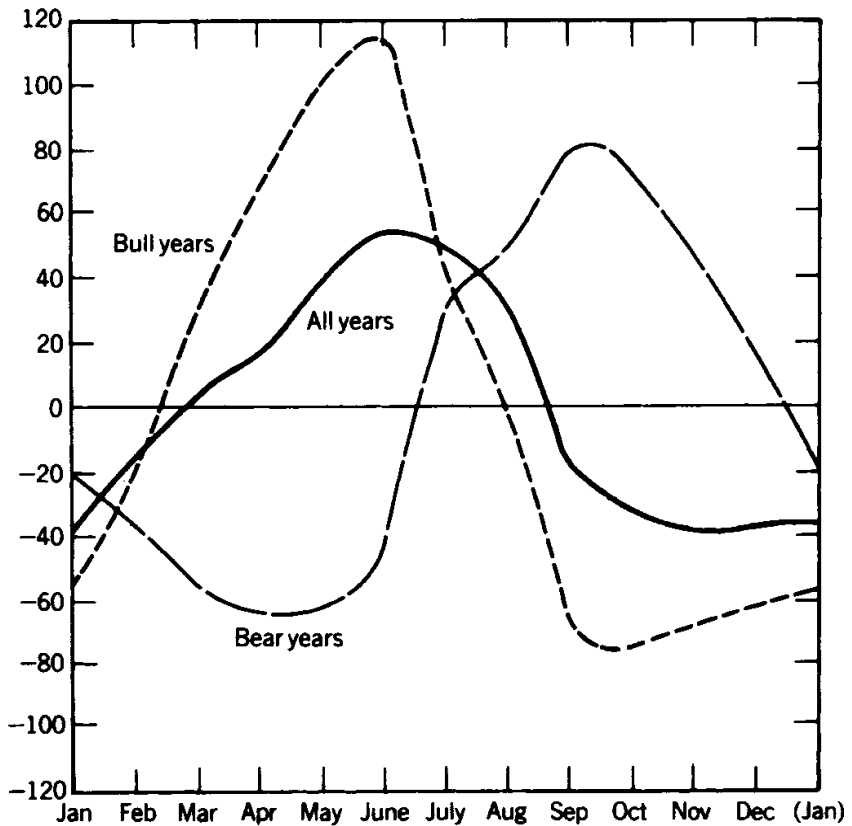
ContiCommodity; Seasonality in Agricultural Futures Markets (ContiCommodity Services, Chicago, 1983).

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FIGURE 77 (a) Corn price seasonality separated into all years, years with good weather, and years with bad weather. (b) Soybeans (10 years) shown with separate bull years (5 years) and bear years (5 years).



(a)



(b)

but the reality of a good crop and normal demand drive prices steadily lower during the second half of the year. The pattern is typically seasonal and very well defined by large swings.

Seasonality for Trading

Whatever method is used to find the seasonal pattern, it is equally important to apply it properly when trading. Select a market that has a dominant seasonal pattern. The crops always qualify, with the exception of potatoes, which are fully stored and do not react to the harvest depression. Livestock tends to be more complex than other commodities

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TABLE 710 Bull, Bear, and Nonseasonal Market Patterns

(a) Bull years begin at relatively low levels, peak during the summer but remain high at the end of the year. (b) Bear years decline steadily after April and do not reflect the concerns that often drive prices higher during the summer. (c) Nonseasonal years follow years in which the harvest months of September-October posted higher prices than the summer months. These years revert back to what we expect of normal seasonal

patterns.

(a) Soybean Bullish Years (Prices Higher at the End of the Year)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
70	-1.83	-1.62	-1.61	-1.25	-1.04	0.11	1.51	0.33	0.28	1.82	2.24	1.07
72	-4.10	-3.42	-1.56	-0.43	-0.78	-1.38	-1.12	-0.06	0.47	0.57	3.23	8.58
73	-25.18	-16.67	-13.26	-11.15	6.23	25.10	15.97	16.73	3.93	-0.42	-1.85	0.57
74	-3.16	-1.87	-3.20	-8.10	-9.14	-8.81	1.80	6.55	5.63	11.83	6.10	2.37
76	-7.34	-7.00	-7.60	-7.58	-4.26	3.74	7.14	3.53	5.90	2.86	4.36	6.26
78	-6.65	-7.41	-0.51	1.37	3.15	1.25	-0.73	-0.78	1.20	3.53	2.64	2.94
80	-0.94	-1.24	-4.79	-7.60	-7.11	-6.48	1.39	2.01	5.98	7.36	10.40	1.03
83	-8.32	-7.86	-7.86	-4.92	-7.08	-9.78	-4.59	12.52	16.19	10.66	7.38	3.67
87	-4.46	-5.68	-5.37	-2.46	2.81	3.28	-0.55	-2.52	0.12	1.90	4.74	8.18
88	-12.45	-12.92	-12.34	-8.34	-2.36	18.32	12.91	9.32	8.59	1.93	-1.75	-0.93
93	-6.34	-7.79	-6.09	-4.82	-3.49	-3.33	12.00	6.95	1.70	-1.91	5.07	8.03
Average	-7.34	-6.68	-5.84	-5.03	-2.10	2.00	4.16	4.96	4.55	3.65	3.87	3.80

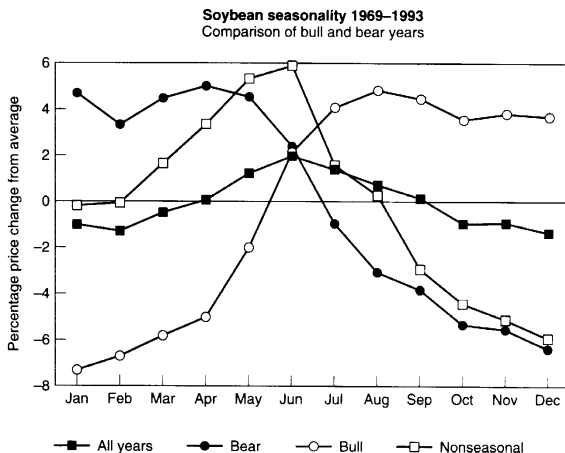
(b) Soybean Bearish Years (Prices Lower at the End of the Year)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
75	7.98	1.69	0.19	1.20	-2.71	-2.85	1.22	5.25	2.23	-1.55	-5.45	-7.20
77	-1.25	0.41	7.48	17.60	16.24	7.35	-6.01	-9.89	-10.31	-9.96	-5.76	-5.90
79	-0.10	3.44	3.78	2.10	0.80	3.83	2.32	-0.83	-0.90	-3.73	-4.92	-5.82
81	10.25	7.30	5.54	7.93	4.75	0.67	0.84	-3.45	-6.58	-7.19	-8.96	-11.09
82	6.26	5.31	3.49	6.10	5.80	2.37	0.66	-3.69	-6.54	-8.14	-5.53	-6.11
84	7.91	4.09	9.25	9.08	14.64	7.31	-4.92	-7.00	-9.44	-9.09	-9.29	-12.53
85	6.79	5.38	5.31	5.87	2.00	2.07	-0.41	-4.72	-4.73	-5.67	-6.62	-5.27
86	2.82	0.16	0.52	-0.42	0.81	0.09	-0.16	-2.48	-1.26	-0.96	1.00	-0.11
89	11.07	6.75	8.28	3.23	2.50	1.71	0.36	-5.51	-6.03	-7.82	-6.76	-7.78
90	1.10	0.21	2.39	3.24	4.90	1.11	0.89	0.39	0.68	-1.09	-6.66	-7.17
91	4.33	4.42	4.56	4.73	1.49	-0.15	-4.66	-0.49	1.46	-3.85	-5.47	-6.36
92	1.32	2.32	4.03	1.15	4.78	6.02	-1.51	-4.59	-3.99	-5.52	-2.73	-1.27
Average	4.87	3.46	4.57	5.15	4.67	2.46	-0.95	-3.08	-3.78	-5.38	-5.59	-6.38

(c) Soybean Nonseasonal (Prices Higher during the Previous September-October than Summer)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
71	-0.31	-0.42	-0.88	-2.35	-1.60	0.34	2.20	1.43	0.52	0.99	0.07	0.01
73	-25.18	-16.67	-13.26	-11.15	6.23	25.10	15.97	16.73	3.93	-0.42	-1.85	0.57
75	7.98	1.69	0.19	1.20	-2.71	-2.85	1.22	5.25	2.23	-1.55	-5.45	-7.20
77	-1.25	0.41	7.48	17.60	16.24	7.35	-6.01	-9.89	-10.31	-9.96	-5.76	-5.90
79	-0.10	3.44	3.78	2.10	0.80	3.83	2.32	-0.83	-0.90	-3.73	-4.92	-5.82
81	10.25	7.30	5.54	7.93	4.75	0.67	0.84	-3.45	-6.58	-7.19	-8.96	-11.09
84	7.91	4.09	9.25	9.08	14.64	7.31	-4.92	-7.00	-9.44	-9.09	-9.29	-12.53
Average	-0.10	-0.02	1.73	3.49	5.48	5.96	1.66	0.32	-2.94	-4.42	-5.17	-5.99

FIGURE 78 Soybean seasonality, a comparison of filtered years.



because of the joint dependency on both feedgrain prices as well as their own production and consumption factors. Both crops and livestock have primarily supply oriented seasonal trends, depressed at harvest and highest during the growing months or depressed in the fall when the livestock supply becomes greatest due to liquidation before winter. Metals patterns are caused by demand, because they have no dependence on weather and production is usually constant. The summer months still see the highest prices due to increased consumption of copper in housing and silver in photography.

Select a delivery month most likely to reflect the pattern to be traded. If a sharp rise in soybeans is expected in July, trade the August contract. Prices of the November delivery, which will also be active, will not move as much because it is both deferred and a new crop. In more extreme cases, February pork bellies do not reflect events occurring in the previous July or August contracts.

Exceptions occur in seasonal patterns as they do in any model. There are events that may overwhelm normal seasonality such as runaway interest rates or inflation, rapid change in the U.S. dollar, or Soviet grain embargoes. Even though the seasonal variation still exists, the size of the price change resulting from these other factors is much greater and tends to obscure the seasonality. It is usually easy to recognize a nonseasonal pattern; prices simply go steadily up when they normally go down, or down when they are expected to go up. From 1972-1974, corn prices increased steadily with only small adjustments in September and October. Once this variation occurs, it may be wise to wait until another season has reestablished the normal pattern.

The systems and methods that follow are based entirely on seasonal patterns and may be used alone or to filter other methods.

Seasonal Studies and Key Dates

Most agricultural commodities exhibit traditional, reliable price moves at one or more periods throughout the year. The grains grown in the

Northern Hemisphere have a high likelihood of a rally during the late spring and early summer, when the chance of drought will have the greatest effect on yield. When prices show the normal harvest lows, followed by a modest rise and sideways pattern throughout the winter, the potential is good for a rally during the early growing season. Because prices start at relatively low levels, the risk of holding a long position is small. Once prices have moved higher, there is rarely a season in which a short sale of corn, soybeans, cotton, or sugar will not net a good profit within the two months before harvest begins.

Seasonal studies are intended to provide information on when the largest move will occur. The following studies (1) Grushcow and Smith (1980), (2) ContiCommodity (1983), and (3) Bernstein (1986) will be used to compare the seasonality in some of the more active commodities. A summary of the results is shown in Table 711. Each study offers a different perspective on seasonality. Grushcow and Smith analyze both cash and individual futures markets over a fairly long period and present complete statistics; ContiCommodity used mostly the past 10 years, but included a unique volatility analysis; Bernstein, the most recently published study (Seasonal Concepts in Futures Trading), gave the most complete background on calculations, including separate studies of bullish and bearish years and an exceptionally long time period for cash market analysis.

The number of years in the seasonal analysis counts heavily in determining the normal patterns. As Table 711 shows, the ContiCommodity results, based on a maximum of 10 years, is often quite different from the other two studies. For trading safety, it would be best to select those patterns that have proved reliable over many years; however, because inconsistency in the past 10 years cannot be ignored, a trader must be able to identify nonseasonal, bullish, or bearish patterns.

The periods that seem consistent throughout all studies are:

Corn and soybeans. September and October show major harvest pressure.

Cattle. An end-of-the-year liquidation and midwinter rally.

Coffee and juice. No common moves in the three studies.

Some commodities are clearly more seasonally consistent than others. Both the coffee and orange juice markets were expected to show patterns that reflect a rise as the possibilities of a freeze increase. It must be that the normal seasonality of these products is distorted by the inconsistent and highly volatile periods that follow a freeze. These markets would be candidates for an analogous years study in which you compare only those years with common factors.

The three studies shown here, as well as most others, include recommended trades based on key dates, which reflect the patterns in Table 710a. By selecting those trades common to all of them, you have found those that are most reliable. In a summary by Bernstein, which catalogues commodities by those months with the highest reliability, the agricultural products are clearly the most seasonal. The only nonagricultural market that shows any consistent seasonality is copper. Although there may be

interesting arguments for the forces of demand on silver, currencies, and financial markets, their inconsistency is apparent and they are not candidates for seasonal trading.

Seasonal Calendar

Because Bernstein's work covers the cash markets over an extremely long period, it must be considered the most reliable source of basic seasonal patterns. Table 712 is part of the

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TABLE 7-11 Results of Seasonal Studies

	J-F	F-M	M-A	A-M	M-J	J-J	J-A	A-S	S-O	O-N	N-D	D-J
<i>Corn</i>												
24 years*	.5	-1.1	1.6	3.6	3.4	.5	1.5	-5.3	-8.5	-1.3	.5	2.1
10 years [†]	2.2	-1.3	-2.3	-1.2	2.3	7.7	4.5	1.4	-7.5	-1.3	-6.4	1.8
46 years [‡]	-6	2.0	3.0	2.9	2.3	3.8	-1.5	-3.2	-6.7	-3.7	5.4	1.5
%*	58	58	67	92	50	46	50	54	88	63	83	71
% [‡]	52	60	80	72	45	59	62	63	82	60	82	70
<i>Soybeans</i>												
24 years*	7.4	7.5	8.4	9.5	6.4	-.7	-1.3	-25.8	-7.5	4.2	5.8	.3
10 years [†]	-2.3	21.1	23.7	12.6	20.0	14.7	-11.7	-14.9	-46.7	-9.8	-8.9	2.1
42 years [‡]	3	11	8	8	3	-1	-5	-20	-8	10	3	2
%*	67	50	67	50	42	38	58	83	63	75	67	79
% [‡]	62	53	57	51	42	37	64	74	64	76	72	70
<i>Cattle</i>												
25 years*	-.4	.1	.6	.1	-.1	.4	.4	-.3	-.4	-.5	-.1	.4
10 years [†]	1.4	.2	.8	1.8	.4	-1.2	-.4	-.7	-1.3	-.5	-.3	-.2
50 years [‡]	1	12	13	4	-1	7	3	4	-9	-9	-2	2
%*	64	60	48	44	56	60	56	44	76	64	52	72
% [‡]	52	70	59	52	52	59	55	42	60	71	51	62
<i>Orange Juice</i>												
10 years*	-1.6	-.1	-.3	-.9	-.9	-.3	.1	-.2	1.2	-2.3	-.3	1.7
10 years [†]	-1.9	2.4	-1.1	-.7	.0	1.6	1.8	2.3	.2	.0	.0	-4.7
34 years [‡]	27	14	4	-3	-8	-1	1	3	-2	-2	-13	-4
%*	78	45	67	56	45	45	56	67	45	45	56	56
% [‡]	61	64	50	58	50	65	66	81	61	40	67	62
<i>Coffee</i>												
22 years*	-.2	.9	-.5	-.4	.1	.1	-.7	-.3	.1	.3	-.5	.1
8 years [†]	-6.5	1.8	7.6	5.0	-.3	3.3	-11.5	-2.0	4.3	-8.6	4.7	2.2
53 years [‡]	0	-10	2	-4	1	4	18	2	19	-10	-4	-2
%*	41	64	50	50	59	46	46	55	41	64	50	77
% [‡]	56	58	43	53	50	48	56	56	51	59	54	49

*Grushcow and Smith (change in price).

†ContiCommodity (% change in seasonal factor).

Bernstein (% change in seasonal factor).

~Approximate values.

% refers to the reliability of monthly seasonality.

weekly seasonal calendar, which appears in Seasonal Concepts in Futures Trading. The numbers that appear show those weeks with consistent historic moves. Weeks of 64% and higher represent upward moves; weeks of 36% and lower display downward trends. This calendar can be extremely useful when combined with some simple trading logic which asks, "Is the market acting in a seasonal manner?" before the position is entered.

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TABLE 712 Seasonal Calendar

TABLE 712 CROPS: 1960-1969

	Mar Corn	May Corn	Jul Corn	Sep Corn	Dec Corn	Mar Wheat	May Wheat	Jul Wheat	Sep Wheat	Dec Wheat	Mar Oats	May Oats	Jul Oats	Sep Oats	Dec Oats	Jan Soybeans	Mar Soybeans	May Soybeans
1 Jan				76			29				66	66					29	
2											66			66				
3	66							22	23	37							66	
4							27		33	37							37	
5 Feb						31		35	37	31								66
6		27				64				75	66							
7	35										31	37	33					
8	35	29				22	27				27						70	
9 Mar	66						35		31	25		23	37	37			35	
10								27	37	31								
11				72		35		35	23	29								
12																		37
13 Apr			66	66			72		79			76	64	81				78
14		77										66	64					70
15							37		33									35
16							33						25	37				26
17			27				22					22						
18 May							37		29	18		83						76
19	35											82	76					
20	70				66													
21						37		33									66	
22 Jun				37					31	29				37		64	35	
23	33		33	35		76			35	28			37	37				
24	76			76		33			64	82							70	
25	33			27	36				37	29								
26 Jul	66		70	66	63								64				76	64
27			66						64				29	26				
28		35						64						35		13		23
29	22	22			21									31		25	17	29
30		27		23	36		27											
31 Aug					35	33												
32											70			66				
33											66			66				
34							83		64			64		66	66	37		
35 Sep				35			72		70	64		66		37				
36									64									66
37			31								70					29		29
38	29				31										35		33	
39																		
40 Oct											64				64	76		64
41						66		72		64						25		35
42					63							66						
43							27	33			70							
44 Nov			27		66	37	33		26			72				31	33	
45										35					79	64		
46																29	33	35
47			64						64									
48 Dec							29		35						66	64		
49	18		35								33							
50												35				29	66	25
51												64			35	35	27	37
52							66											

Jul Soybeans	Aug Soybeans	Sep Soybeans	Nov Soybeans	Jan Soybean Meal	Mar Soybean Meal	May Soybean Meal	Jul Soybean Meal	Sep Soybean Meal	Dec Soybean Meal	Mar Soybean Oil	May Soybean Oil	Jul Soybean Oil	Sep Soybean Oil	Dec Soybean Oil	Feb Live Cattle	Apr Live Cattle	Jun Live Cattle	Aug Live Cattle	Oct Live Cattle
37							33			35									
64	64									66						64			
								29			77	66					64		
	37					33			66	66					66			66	
	64	70			28			37	37	70	64	62			64		76		
					37										66			75	
64	64												66		76		64		
							35				33							37	
		35				66	35	23	23	35						77	76	66	
					66			70		70	66							66	66
					37	35										66	70		
37											33						37		
	64					70	70				72					72	76	71	
64			63					70	66						64	66	76		
		25						37									64	75	66
23						29	17				33		66						
			36					29	29		70				64			66	
75											27						64		33
70	64	66			64			70							70				66
								64	75	27		33					70	75	66
23	33	37		66	66	31		31				27	33	22		64		64	
64								76					33	66	66				
37				64	81	66		66	66	70	33		66	66					33
	70			72							72							66	
75			66				64		66	70		72		72	66	77	73		
	64			66		76			64							37			77
			63		66	29									33				
	33	25	15	33	20	35		29	25		29								
			28					35	35				64						
								35	35									66	
					37			37											
								70	75		33								
		37			37			29	35	27	64		29	10					37
64		35				64					64			64	66	35			70
29			66		29		76	66		27					37				
								37							66				
																37			
64				36	72									35	33				
35				73		66		36		76	64			72					
				35							23							31	
										64									
64				77	66		70								33		35		
					75		64								70	72	13	64	
			76			66									64	70	75		
											16				66	70	76		
			37			35		37	29	66				27			66		
					66	66	72			66	33								
									70					33					
33	29			35	31					66	29				66	66			
37	35	31								11	27	22			64			66	

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TABLE 712 (Continued)

	Dec Live Cattle	Mar Feeder Cattle	Apr Feeder Cattle	Sep Feeder Cattle	Oct Feeder Cattle	Nov Feeder Cattle	Feb Live Hogs	Apr Live Hogs	Jun Live Hogs	Jul Live Hogs	Aug Live Hogs	Oct Live Hogs	Dec Live Hogs	Feb Pork Bellies	Mar Pork Bellies	May Pork Bellies	Jul Pork Bellies	Aug Pork Bellies	Mar Cocoa	May Cocoa	Jul Cocoa	Dec Cocoa
1 Jan									66					64	37							
2							70	77			76			70	66							33
3			66						66	80	76				66	64	64		35			
4									73	64						66		62				
5 Feb		70								64	66			64	81							
6	66						64								37				64			
7																	35		35	33		
8		20			36			35	66									66		66		
9 Mar	80	80	70		63			66									70		75		66	
10					63	70																
11				35					33									64	35	27	27	
12	37				63						73											68
13 Apr									66		70	64					66					
14	72		90	80	63	90		77	78	87		71					33	31				38
15			80	81	72	66						33					66	78		66		
16					81												23	23		22	38	
17									64	64												
18 May				30	33	30			66	73												
19					27				80													
20				70						29	31								37	29	27	
21				63	81	80												17	35		66	
22 Jun						77					35	26	27	35				35	23			33
23	33			36		30				31					37					37		33
24	70				36					70				70				70				66
25				72	63						64		66					70		76	77	
26 Jul	66				72	66					35				66			75				72
27				36	80									64						64	77	66
28				36	27													66			77	64
29											35				37							
30					27																	
31 Aug					36						66						64		64	66		
32				72	63						76	66	72						64			36
33					36						70			76	66			64		33		
34				63		30					37	38								64	83	
35 Sep	70			63		80					73	66		70	66		81		70			77
36				63	72	70						66								33		66
37						70									37							
38						30																
39	27																				33	
40 Oct	33				70							31			29	33	29	23				
41													27		31				29	33		
42	35				36													37	70			
43	22													66	33		75			72	64	
44 Nov							82	83	71					72	64	66	72		66	70	29	
45	70													77	70			80	25	33	33	
46		70						84						77								27
47																						
48 Dec						64									35		35		64	66		72
49	33		66											66								
50														76		37	66	64				
51									64						73		77	76				
52																						

TABLE 7-12 (Continued)

Jan Orange Juice	May Orange Juice	Sep Orange Juice	Nov Orange Juice	Mar Sugar	May Sugar	Jul Sugar	Oct Sugar	Mar Coffee	May Coffee	Jul Coffee	Sep Coffee	Dec Coffee	Mar Cotton	May Cotton	Jul Cotton	Oct Cotton	Dec Cotton	Jan Lumber	Mar Lumber	May Lumber	Jul Lumber	Sep Lumber	Nov Lumber
31	35	29								63				75	87	86			66				
		35			77	70		63		66						75		66					
37								27	18	27					64			30		69		28	
	35				35			66	75						35	33				69	64		
						35		63		72	81								71	69	69	66	
						70		66	91	75	63								15	69	64	63	
		35						72		33			70	35	37	18	37						76
	35	29	33	62	72	35		36	25		66		64	64	70	68			21	7	28	72	28
								70	66			72						30		35	16		
25		31		64	29	37	36	36	33		33			37	35	31							33
26	29	12	16		27	37	36	80	75		83	72			35				35	69			30
				22					66	33				70		75				15		25	35
31	64		70						75	36	36											36	7
31		37	37				36		66	66	66	72		66								33	
75					33	37				63	63								70				
75	64	76	76					63	66	75		27		29	26								
																		30					
			77		33		36	72			72	80		75		68		27		30	7	25	23
					35			72			66	63		76			70				35	33	35
68		35						36		75	72	72				70		66	23			25	
68										66		36	35		37	31	35	69			28	83	14
33			64				64						29				29				78	33	83
35			33	33			36	36		33				70		37		66					35
			35				33	36				27	70				75	69				75	64
66		35	27			29		36			33												
						35							36	64									
73			66									36		68			37	30					35
		64			29								70			35		72		15	35		28
			64				36	63		66				76				?				66	71
							36							64									
			70					63			66	80											28
37								72			66	63	37				37						71
73				66		66		27				36	64	64			37					66	
73		82	66		76			36	75								66						
			70	66				72			66	36		35	35			30					69
							36			63	33	63	35	35		37		25	7			25	28
75					27	37	36	63	66			63	23	37	29	12			35	23			28
												63					23						
81	82		64	11		35			36	33		81						33					28
			64														81	66	75				
		76			72	66	70	68	36			63	27	70	68	68		76					
75	64		66	72	64	75		66	75	83						37							
80				72				90	66	75	83	63	64	64				66	66	71	76	71	
									63	63													71
					70		72	70		63	63	66		35	35	35	37	35	84	69	69		64
				66			64						63			66							
				64				72	75	75	66			35			37						
						64	70			72	66		63						33			30	
					66	33		72	83	83	75	63	64		35				69	76	85	83	
26	18			33		35					63									76			66

COMMON SENSE AND SEASONALITY

Nonseasonal Markets

Most comprehensive works on seasonality include not only agricultural markets but currencies, interest rates, and indices. Common sense tells us that the primary feedgrains follow a clear seasonal pattern based upon a single crop year. This calendar cycle also applies to coffee,

cocoa, and oranges, although competition from South America has limited the extreme moves that resulted from a freeze in Florida's orange groves. Grain seasonality has been slowly changing as well, as Brazil improves their production of soybeans. Cattle and hog prices, dependent upon the cost of feed, and still marketed more actively in the fall because of weather, show a strong seasonal trend even though they have a growth and feeding cycle that is not confined to a calendar year. Livestock patterns have adjusted to longterm competition from Australia and New Zealand.

These agricultural markets are reasonable candidates for seasonal analysis, but may require careful study to identify shifting patterns in competition and storage. What about Treasury bonds or the Japanese yen? Should we look for seasonal patterns in the financial markets? While we can argue that certain stocks are highly dependent upon seasonal business, can we say that the demand on money is higher in the summer than in the winter, or that enough tourists convert their currencies to yen when they visit japan during the summer that this effect drives the value of the yen consistently higher? Are automobile exports from japan stronger or weaker during a certain season, so that there is a predictable pattern? These scenarios are highly unlikely and have no assurance, such as the coming of winter, that cars must be sold the way grain must be harvested. In financial markets the players can choose their time to act; they can hedge their commitments or wait for a better opportunity. This choice makes any pattern that might exist uncertain. The study of seasonality should be limited to those markets that depend on weather and seasons, either directly or indirectly.

Being Too Specific about Targets

Nature is not precise and selecting an optimal day of the year to set a long position is not likely to work. Small shifts in fundamentals, such as the building of additional storage, will allow farmers to change their selling habits slightly. The right day to buy or sell in 1975 is not likely to be the right day this year. Even weekly data may be a little too specific. Seasonal patterns are best seen using monthly data. The most we might expect is to know that the seasonal high in corn usually occurs in July but sometimes in June or August; the harvest lows are likely in September but could be in October or November. We must first be aware of the big picture, then study how the specific pattern develops each year.

Recognizing Nonseasonal Years and External Factors

The studies of bull and bear market years shown in this book should make it clear that seasonality is not at all consistent. It is only a few years that cause prices to show extreme highs during the summer, while there are years in which the patterns are influenced by external factors and do not show normal seasonality. Seasonality, although a clear concept and a fact of nature, is not a trivial analysis when applied to trading. Each year must be observed and categorized, then a reasonable trading plan must be defined for that situation.